

## Supplementary Material

**Tab. S1** - General site and stand characteristics of black pine and red pine stands in the study sites.

Tree species	Region	Location	Annual precipitation (mm)	Annual temperature (°C)	Aspect	Elevation (m)	Slope (°)	Parent material	Stand density (trees ha <sup>-1</sup> )	No. of sample	Basal area (m <sup>2</sup> ha <sup>-1</sup> )	Volume (m <sup>3</sup> ha <sup>-1</sup> )
Black pine	Goheung 1 (GH1)	34°30'36"N	1453	13.6	S	41	15-20	Gneiss	600	5	17.83	139
		127°05'58"E										
	Goheung 2 (GH2)	34°30'37"N	1453	13.6	S	43	10-15	Gneiss	800	5	16.85	119
		127°05'56"E										
	Gwangyang (GY)	34°55'41"N	1439	14.3	SE	230	15	Gneiss	2800	5	6.82	27
	Jinju 1 (JJ1)	35°12'07"N	1512	13.1	NW	139	21	Sandstone	475	5	16.79	130
	Jinju 2 (JJ2)	35°12'12"N	1512	13.1	S	85	20-25	Sandstone	1000	8	20.15	132
	Jinju 3 (JJ3)	35°10'48"N	1512	13.1	SE	144	20-25	Sandstone	400	8	20.87	188
	Jinju 4 (JJ4)	35°09'90"N	1512	13.1	SE	131	10-15	Sandstone	325	8	34.39	394
	Sacheon (SA)	35°07'13"N	1512	13.1	N	117	10-15	Sandstone	600	5	19.34	150
Mean	-	-	-	-	-	-	-	875±285	49	19.1 (2.7)	160 (37)	
										[6.8-34.4]	[27-394]	
Red pine	Hadong (HD)	35°12'25"N	1794	14.2	S	755	25	Granite	925	5	50.93	347
	Hamyang (HY)	35°27'11"N	1178	11.4	SW	746	20	Granite	975	5	31.38	200
	Jinju 5 (JJ5)	35°12'26"N	1528	13.1	SW	135	27	Sandstone	1120	5	24.68	144
	Sancheong (SC)	35°29'35"N	1485	12.7	SW	766	20	Granite	950	5	34.86	201
	Uiryong (UR)	35°22'56"N	1300	13.4	NW	76	23	Sandstone	2200	5	19.90	105
	Mean	-	-	-	-	-	-	-	1234±264	25	31.2 (5.8)	199 (41)
										[19.9-50.9]	[105-347]	

Values in parentheses are standard error. Values in bracket are range.

**Tab. S2** - General characteristics of sampled trees in black pine and red pine.

Tree species	Region	Tree age (yrs)	D <sub>20</sub> (cm)	DBH (cm)	Height (m)	Stem density (g cm <sup>-3</sup> )	
Black pine	Goheung 1 (GH1)	41 (2) [33-50]	22.3 (3.0) [11.5-29.1]	17.4 (2.6) [8.6-23.5]	11.5 (1.7) [6.4-14.4]	0.59 (0.03) [0.54-0.69]	
	Goheung 2 (GH2)	38 (2) [30-43]	18.4 (3.3) [9.7-29.0]	15.8 (3.2) [8.2-26.4]	10.4 (1.1) [8.3-14.2]	0.56 (0.02) [0.46-0.61]	
	Gwangyang (GY)	14 (1) [13-16]	11.9 (0.7) [9.6-13.6]	8.6 (0.6) [6.7-10.0]	4.2 (0.3) [3.2-4.7]	0.50 (0.03) [0.41-0.58]	
	Jinju 1 (JJ1)	44 (1) [42-46]	24.8 (3.1) [17.1-35.1]	21.2 (2.8) [14.2-30.0]	16.5 (0.8) [14.7-18.4]	0.50 (0.03) [0.40-0.54]	
	Jinju 2 (JJ2)	35 (1) [28-39]	24.1 (2.1) [14.6-32.4]	20.8 (1.9) [11.5-25.6]	12.9 (0.8) [8.5-15.2]	0.45 (0.01) [0.43-0.49]	
	Jinju 3 (JJ3)	51 (1) [48-54]	28.8 (1.6) [22.8-36.6]	24.9 (1.6) [17.8-32.9]	18.0 (1.1) [12.9-22.2]	0.50 (0.03) [0.43-0.68]	
	Jinju 4 (JJ4)	62 (3) [50-71]	36.6 (2.7) [26.1-45.7]	31.5 (2.1) [25.3-39.8]	21.5 (1.1) [16.2-25.0]	0.48 (0.04) [0.27-0.68]	
	Sacheon (SA)	45 (2) [38-50]	22.7 (3.9) [13.0-35.2]	19.2 (3.3) [10.7-29.4]	18.6 (1.2) [14.4-21.2]	0.48 (0.02) [0.44-0.53]	
	Mean	43 (2) [13-71]	24.8 (1.3) [9.6-45.7]	21.0 (1) [6.7-39.8]	14.8 (0.8) [3.2-25.0]	0.50 (0.01) [0.27-0.69]	
	Red pine	Hadong (HD)	43 (3) [35-51]	27.7 (3.5) [15.7-36.6]	25.7 (3.6) [13.3-40.9]	17.6 (0.4) [16.1-18.7]	0.42 (0.01) [0.36-0.44]
		Hamyang (HY)	36 (1) [33-38]	26.6 (4.4) [15.4-40.4]	19.3 (4.4) [11.2-36.3]	14.8 (1.0) [12.1-16.7]	0.39 (0.02) [0.32-0.43]
		Jinju 5 (JJ5)	39 (2) [36-48]	20.4 (2.2) [16.2-28.7]	15.7 (2.5) [10.2-25.3]	10.9 (0.8) [8.5-12.8]	0.45 (0.02) [0.38-0.51]
		Sancheong (SC)	42 (3) [33-50]	25.0 (4.0) [11.7-36.1]	20.2 (3.4) [9.7-30.3]	13.8 (0.5) [13.1-15.4]	0.46 (0.01) [0.44-0.50]
		Uiryong (UR)	19 (1) [18-19]	13.2 (2.4) [7.9-21.7]	10.5 (1.9) [6.1-16.7]	8.9 (0.3) [8.0-10.0]	0.37 (0.03) [0.29-0.45]
Mean		36 (2) [18-51]	22.6 (1.8) [7.9-40.4]	17.9 (1.5) [6.8-34.3]	13.2 (0.7) [8.7-18.7]	0.42 (0.01) [0.29-0.51]	

Values in parentheses are standard error. Values in bracket are range. D<sub>20</sub>: diameter at 0.2 m height at aboveground tree. DBH: diameter at breast height (1.2m). Values followed by different letters indicate significant differences at  $P < 0.05$ . Stem density: stem biomass/stem volumes.

**Tab. S3** – Dry weight, N and C concentration of black pine and red pine tree sampled from study sites.

Region	Tree species	Tree age	D20 (cm)	DBH (cm)	Height (m)	Volume (m <sup>3</sup> )	Stem wood (kg)	Stem bark (kg)	Branch (kg)	Needle (kg)	Above ground (kg)
GH	black pine	43	26.2	20.9	14.2	0.257	130.030	11.745	26.308	13.285	181.368
GH	black pine	43	24.1	18.8	14.4	0.238	117.428	10.975	10.757	11.722	150.882
GH	black pine	38	20.4	15.6	8.4	0.094	51.415	6.777	18.936	16.597	93.725
GH	black pine	45	29.1	23.5	14.4	0.308	156.674	12.596	67.574	20.768	257.611
GH	black pine	37	11.5	8.6	6.4	0.027	15.572	2.626	6.515	2.700	27.413
GH	black pine	38	15.1	11.6	10.4	0.065	34.674	3.818	8.231	5.619	52.342
GH	black pine	41	16.1	14.1	8.4	0.068	36.265	4.948	11.882	9.446	62.542
GH	black pine	43	21.9	18.7	14.2	0.207	109.538	11.540	26.023	16.045	163.146
GH	black pine	40	29.0	26.4	10.9	0.331	168.713	12.880	59.776	28.362	269.732
GH	black pine	30	9.7	8.2	8.3	0.029	11.817	1.725	2.508	2.605	18.654
GY	black pine	13	13.6	10.0	4.4	0.021	10.248	1.993	7.400	5.758	25.399
GY	black pine	14	11.8	9.1	4.4	0.017	5.981	1.148	3.621	5.086	15.836
GY	black pine	13	9.6	6.7	3.2	0.009	4.144	0.750	2.356	2.628	9.878
GY	black pine	14	13.1	9.4	4.7	0.019	8.938	1.399	3.994	4.716	19.047
GY	black pine	16	11.5	7.7	4.4	0.014	5.226	0.848	2.191	2.191	10.456
SA	black pine	50	35.2	29.4	20.4	0.805	351.180	22.608	52.147	17.957	443.893
SA	black pine	43	18.3	15.1	18.2	0.192	91.384	9.808	3.242	3.156	107.590
SA	black pine	38	13.0	10.7	14.4	0.072	28.213	3.521	2.397	0.524	34.655
SA	black pine	49	19.8	17.7	18.6	0.242	102.245	11.465	7.514	4.411	125.636
SA	black pine	45	27.4	23.2	21.4	0.434	203.434	17.339	35.836	9.551	266.160
JJ1	black pine	44	26.9	24.3	18.4	0.412	197.343	19.669	18.462	13.514	248.988
JJ1	black pine	46	19.9	16.7	14.7	0.185	83.683	11.966	33.605	16.664	145.919
JJ1	black pine	46	35.1	30.0	18.2	0.595	298.746	24.776	94.248	27.191	444.961

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Region	Tree species	Tree age	D20 (cm)	DBH (cm)	Height (m)	Volume (m <sup>3</sup> )	Stem wood (kg)	Stem bark (kg)	Branch (kg)	Needle (kg)	Above ground (kg)
JJ1	black pine	42	17.1	14.2	14.7	0.144	51.111	6.886	8.282	4.480	70.759
JJ1	black pine	44	25.2	20.6	16.4	0.288	131.664	16.495	44.671	17.089	209.919
JJ4	black pine	60	29.6	25.3	16.2	0.401	193.910	21.546	78.636	37.364	331.456
JJ4	black pine	62	45.7	39.8	24.3	1.266	496.353	55.150	148.383	50.857	750.743
JJ4	black pine	71	34.9	29.3	18.7	0.607	148.013	16.446	60.432	38.362	263.253
JJ4	black pine	68	26.1	25.4	21.0	0.426	259.618	28.846	39.940	26.132	354.536
JJ4	black pine	67	43.8	39.0	25.0	1.204	548.073	60.897	115.681	38.261	762.912
JJ4	black pine	50	28.6	25.6	19.2	0.452	201.815	22.424	82.372	39.519	346.130
JJ4	black pine	54	39.1	32.2	24.0	0.835	363.142	40.349	93.422	40.111	537.024
JJ4	black pine	61	42.9	35.4	23.7	0.996	403.524	44.836	77.000	20.289	545.649
JJ2	black pine	33	14.6	11.5	8.5	0.060	25.976	3.210	8.557	3.200	40.943
JJ2	black pine	30	18.4	16.0	13.2	0.157	63.261	7.819	14.304	7.753	93.137
JJ2	black pine	28	20.1	18.1	13.2	0.177	72.545	8.966	17.954	6.939	106.404
JJ2	black pine	36	24.3	19.8	11.4	0.201	80.932	10.003	26.317	11.737	128.989
JJ2	black pine	34	25.7	24.5	15.2	0.319	121.877	15.063	35.893	8.719	181.552
JJ2	black pine	38	28.0	24.8	12.6	0.317	123.358	15.247	45.586	12.703	196.894
JJ2	black pine	38	29.3	25.1	15.2	0.373	153.798	19.009	50.848	18.122	241.777
JJ2	black pine	39	32.4	26.5	14.2	0.386	156.134	19.297	40.528	15.061	231.020
JJ3	black pine	52	36.6	32.9	21.2	0.905	350.939	43.374	91.649	42.986	528.948
JJ3	black pine	50	29.0	24.5	17.8	0.444	169.728	20.978	34.217	13.086	238.009
JJ3	black pine	52	32.6	28.5	22.2	0.650	301.867	37.309	44.895	40.270	424.341
JJ3	black pine	48	22.8	17.8	15.2	0.176	106.422	13.153	32.012	13.373	164.960
JJ3	black pine	49	24.1	22.1	12.9	0.241	108.642	13.428	33.330	15.553	170.953
JJ3	black pine	51	30.7	26.6	18.2	0.573	235.101	29.057	52.245	24.982	341.385
JJ3	black pine	54	27.1	23.6	20.2	0.412	171.811	21.235	38.340	17.475	248.861
JJ3	black pine	51	27.3	23.0	16.1	0.330	155.287	19.193	35.524	21.977	231.981

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Region	Tree species	Tree age	D20 (cm)	DBH (cm)	Height (m)	Volume (m <sup>3</sup> )	Stem wood (kg)	Stem bark (kg)	Branch (kg)	Needle (kg)	Above ground (kg)
JJ5	red pine	39	19.4	15.2	10.3	0.085	29.138	5.917	11.202	4.769	51.025
JJ5	red pine	39	20.7	16.6	8.5	0.085	33.085	5.843	14.100	2.601	55.629
JJ5	red pine	39	16.2	9.7	10.5	0.043	19.025	3.401	7.535	5.090	35.051
JJ5	red pine	39	28.7	23.3	12.8	0.224	69.347	13.077	19.594	2.862	104.880
JJ5	red pine	39	17.1	15.6	12.2	0.098	32.066	7.841	8.231	5.050	53.188
HY	red pine	36	40.4	34.3	16.5	0.640	242.951	30.673	76.484	8.527	358.635
HY	red pine	36	21.7	15.0	16.1	0.113	31.546	4.840	9.866	3.216	49.468
HY	red pine	36	32.0	23.9	12.7	0.264	81.452	11.836	11.806	5.932	111.027
HY	red pine	36	23.4	18.3	16.7	0.164	56.981	10.749	10.424	3.146	81.300
HY	red pine	36	15.4	10.6	12.1	0.054	20.319	2.717	2.574	1.067	26.676
SC	red pine	42	23.9	18.4	12.6	0.178	71.367	9.273	10.571	4.719	95.930
SC	red pine	42	11.7	8.9	13.4	0.046	19.525	2.597	1.065	0.825	24.012
SC	red pine	42	36.1	27.8	13.4	0.431	175.375	13.682	45.137	11.971	246.165
SC	red pine	42	24.0	19.4	14.4	0.178	64.875	9.616	5.225	3.339	83.056
SC	red pine	42	29.1	24.3	15.4	0.239	96.904	17.049	22.055	5.297	141.305
UR	red pine	19	9.9	6.8	8.0	0.017	5.266	1.781	3.163	1.084	11.294
UR	red pine	19	21.7	16.2	9.0	0.093	26.453	6.999	20.944	5.133	59.529
UR	red pine	19	14.0	11.4	10.0	0.047	16.302	4.935	5.301	1.984	28.522
UR	red pine	19	12.7	9.7	9.0	0.034	8.375	2.731	2.246	1.513	14.865
UR	red pine	19	7.9	7.5	8.7	0.016	2.841	1.908	0.849	0.338	5.936
HD	red pine	43	15.7	12.5	16.1	0.111	40.170	3.389	2.020	1.023	46.601
HD	red pine	43	32.1	27.0	18.1	0.502	159.179	24.245	20.695	7.762	211.881
HD	red pine	43	25.4	20.1	17.4	0.272	110.837	9.702	10.032	3.330	133.900
HD	red pine	43	36.6	32.0	18.7	0.676	255.822	28.131	51.780	9.496	345.229
HD	red pine	43	28.5	24.2	17.7	0.362	138.910	16.055	15.789	6.501	177.255

**Tab. S4** – Nitrogen and Carbon concentration of black pine and red pine tree sampled from study sites.

Region	Tree species	Tree age	D20 (cm)	DBH (cm)	Height (m)	Nitrogen (kg)				Carbon (%)			
						Stem wood	Stem bark	Branch	Needle	Stem wood	Stem bark	Branch	Needle
GH	black pine	43	26.2	20.9	14.2	0.039	0.268	0.254	0.672	50.2	47.5	48.5	49.7
GH	black pine	43	24.1	18.8	14.4	0.042	0.348	0.233	0.844	48.2	48.2	48.7	49.9
GH	black pine	38	20.4	15.6	8.4	0.038	0.242	0.212	0.926	47.8	49.0	48.8	50.7
GH	black pine	45	29.1	23.5	14.4	0.051	0.269	0.305	0.724	48.1	47.3	48.1	49.3
GH	black pine	37	11.5	8.6	6.4	0.041	0.240	0.158	0.798	47.9	47.5	48.3	49.2
GH	black pine	38	15.1	11.6	10.4	0.033	0.241	0.253	0.810	48.4	49.2	48.5	51.3
GH	black pine	41	16.1	14.1	8.4	0.034	0.179	0.271	0.908	47.2	47.4	48.9	49.9
GH	black pine	43	21.9	18.7	14.2	0.033	0.231	0.209	0.799	49.8	48.0	49.7	49.2
GH	black pine	40	29.0	26.4	10.9	0.023	0.255	0.187	0.781	47.6	47.6	47.1	51.0
GH	black pine	30	9.7	8.2	8.3	0.044	0.278	0.288	0.833	47.1	47.7	48.1	49.6
GY	black pine	13	13.6	10.0	4.4	0.095	0.261	0.261	0.682	48.0	49.0	48.5	49.9
GY	black pine	14	11.8	9.1	4.4	0.063	0.231	0.365	0.859	47.8	48.9	48.5	49.5
GY	black pine	13	9.6	6.7	3.2	0.051	0.277	0.219	0.716	47.9	49.2	48.6	49.7
GY	black pine	14	13.1	9.4	4.7	0.053	0.297	0.281	0.695	47.6	48.3	49.2	49.3
GY	black pine	16	11.5	7.7	4.4	0.052	0.357	0.343	0.762	47.6	48.0	47.9	50.7
SA	black pine	50	35.2	29.4	20.4	0.047	0.308	0.288	1.313	47.8	47.9	48.8	49.8
SA	black pine	43	18.3	15.1	18.2	0.040	0.324	0.338	1.226	46.5	48.8	48.7	50.4
SA	black pine	38	13.0	10.7	14.4	0.056	0.337	0.313	0.921	46.8	47.6	46.9	49.7
SA	black pine	49	19.8	17.7	18.6	0.065	0.385	0.252	0.957	47.1	50.3	47.8	50.5
SA	black pine	45	27.4	23.2	21.4	0.031	0.391	0.303	1.118	47.1	49.4	47.9	51.4
JJ1	black pine	44	26.9	24.3	18.4	0.052	0.279	0.215	1.041	47.4	47.5	46.6	50.0
JJ1	black pine	46	19.9	16.7	14.7	0.074	0.243	0.238	1.343	46.5	47.1	46.9	49.9
JJ1	black pine	46	35.1	30.0	18.2	0.049	0.249	0.244	1.031	47.8	48.5	47.2	49.5

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Region	Tree species	Tree age	D20 (cm)	DBH (cm)	Height (m)	Nitrogen (kg)				Carbon (%)			
						Stem wood	Stem bark	Branch	Needle	Stem wood	Stem bark	Branch	Needle
JJ1	black pine	42	17.1	14.2	14.7	0.043	0.276	0.205	0.879	46.8	47.1	46.6	49.6
JJ1	black pine	44	25.2	20.6	16.4	0.042	0.331	0.185	0.737	46.7	46.9	46.6	49.2
JJ4	black pine	60	29.6	25.3	16.2	0.021	0.148	0.192	0.826	46.5	48.4	47.5	48.9
JJ4	black pine	62	45.7	39.8	24.3	0.028	0.202	0.206	0.783	47.2	47.1	47.8	50.5
JJ4	black pine	71	34.9	29.3	18.7	0.014	0.175	0.224	0.700	47.2	47.7	50.1	49.9
JJ4	black pine	68	26.1	25.4	21.0	0.021	0.176	0.199	0.776	47.2	48.0	49.5	50.6
JJ4	black pine	67	43.8	39.0	25.0	0.018	0.140	0.127	0.728	48.4	46.9	47.6	48.9
JJ4	black pine	50	28.6	25.6	19.2	0.017	0.166	0.178	0.647	46.8	47.8	47.9	49.1
JJ4	black pine	54	39.1	32.2	24.0	0.021	0.189	0.151	0.574	47.2	48.0	48.0	49.3
JJ4	black pine	61	42.9	35.4	23.7	0.019	0.178	0.181	0.709	47.0	47.9	48.5	50.1
JJ2	black pine	33	14.6	11.5	8.5	0.020	0.183	0.196	0.765	47.1	47.9	49.0	49.4
JJ2	black pine	30	18.4	16.0	13.2	0.020	0.180	0.175	0.748	47.1	47.9	49.5	49.4
JJ2	black pine	28	20.1	18.1	13.2	0.012	0.199	0.181	0.626	46.9	47.2	48.2	48.5
JJ2	black pine	36	24.3	19.8	11.4	0.030	0.120	0.193	0.640	47.5	48.7	47.9	49.9
JJ2	black pine	34	25.7	24.5	15.2	0.021	0.160	0.202	0.658	47.2	48.0	48.9	49.4
JJ2	black pine	38	28.0	24.8	12.6	0.025	0.140	0.216	0.888	47.4	48.3	48.1	49.0
JJ2	black pine	38	29.3	25.1	15.2	0.009	0.246	0.265	0.763	47.2	47.3	50.1	50.3
JJ2	black pine	39	32.4	26.5	14.2	0.023	0.241	0.293	0.760	48.0	47.8	48.4	49.6
JJ3	black pine	52	36.6	32.9	21.2	0.022	0.250	0.227	0.902	47.6	48.2	48.4	50.3
JJ3	black pine	50	29.0	24.5	17.8	0.022	0.246	0.185	0.664	47.6	48.0	47.9	49.2
JJ3	black pine	52	32.6	28.5	22.2	0.022	0.248	0.201	0.722	47.6	48.1	49.7	50.1
JJ3	black pine	48	22.8	17.8	15.2	0.016	0.194	0.147	0.717	47.0	49.2	49.2	49.8
JJ3	black pine	49	24.1	22.1	12.9	0.016	0.221	0.171	0.552	47.0	48.6	49.1	49.2
JJ3	black pine	51	30.7	26.6	18.2	0.019	0.186	0.199	0.588	46.7	47.6	47.5	48.6
JJ3	black pine	54	27.1	23.6	20.2	0.019	0.203	0.193	0.644	46.7	48.1	47.2	48.9
JJ3	black pine	51	27.3	23.0	16.1	0.019	0.195	0.117	0.789	46.7	47.8	48.7	50.2

Kim C, Yoo BO, Jung SY, Lee KS (2017). **Allometric equations to assess biomass, carbon and nitrogen content of black pine and red pine trees in southern Korea.**

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Region	Tree species	Tree age	D20 (cm)	DBH (cm)	Height (m)	Nitrogen (kg)				Carbon (%)			
						Stem wood	Stem bark	Branch	Needle	Stem wood	Stem bark	Branch	Needle
JJ5	red pine	39	19.4	15.2	10.3	0.050	0.177	0.290	0.800	49.0	50.4	48.4	49.3
JJ5	red pine	39	20.7	16.6	8.5	0.079	0.210	0.258	0.849	47.7	48.1	45.2	52.3
JJ5	red pine	39	16.2	9.7	10.5	0.105	0.174	0.367	0.805	46.8	49.6	48.1	50.2
JJ5	red pine	39	28.7	23.3	12.8	0.061	0.196	0.268	0.868	48.8	50.1	51.7	52.0
JJ5	red pine	39	17.1	15.6	12.2	0.055	0.246	0.338	0.868	48.0	48.1	47.8	51.3
HY	red pine	36	40.4	34.3	16.5	0.143	0.303	0.342	1.101	47.7	49.8	48.5	50.5
HY	red pine	36	21.7	15.0	16.1	0.071	0.235	0.342	1.000	46.5	49.0	48.5	49.7
HY	red pine	36	32.0	23.9	12.7	0.070	0.175	0.212	1.191	46.9	50.0	47.0	49.8
HY	red pine	36	23.4	18.3	16.7	0.045	0.168	0.399	1.382	46.2	51.6	48.1	49.8
HY	red pine	36	15.4	10.6	12.1	0.063	0.196	0.231	1.382	46.8	49.6	47.6	49.8
SC	red pine	42	23.9	18.4	12.6	0.067	0.175	0.539	0.987	45.8	49.1	49.8	49.2
SC	red pine	42	11.7	8.9	13.4	0.083	0.265	0.463	1.327	46.6	48.8	47.9	48.6
SC	red pine	42	36.1	27.8	13.4	0.055	0.291	0.346	1.056	46.9	48.9	48.4	48.6
SC	red pine	42	24.0	19.4	14.4	0.061	0.217	0.271	1.199	50.0	48.3	46.3	49.1
SC	red pine	42	29.1	24.3	15.4	0.065	0.280	0.329	1.257	46.2	49.4	47.0	50.3
UR	red pine	19	9.9	6.8	8.0	0.065	0.203	0.287	1.057	46.6	45.9	46.9	49.7
UR	red pine	19	21.7	16.2	9.0	0.047	0.203	0.278	0.804	46.9	45.9	47.5	49.2
UR	red pine	19	14.0	11.4	10.0	0.060	0.220	0.361	1.126	47.9	48.6	47.1	49.0
UR	red pine	19	12.7	9.7	9.0	0.203	0.175	0.296	0.867	45.9	49.1	47.0	49.1
UR	red pine	19	7.9	7.5	8.7	0.203	0.234	0.269	0.935	45.9	48.8	46.9	47.9
HD	red pine	43	15.7	12.5	16.1	0.058	0.205	0.402	1.071	47.8	49.1	49.9	51.0
HD	red pine	43	32.1	27.0	18.1	0.056	0.300	0.207	0.885	48.1	50.3	48.6	50.7
HD	red pine	43	25.4	20.1	17.4	0.062	0.288	0.375	1.185	47.4	49.8	49.7	50.5
HD	red pine	43	36.6	32.0	18.7	0.050	0.265	0.256	0.926	47.0	49.1	48.0	51.5
HD	red pine	43	28.5	24.2	17.7	0.061	0.272	0.472	1.156	49.1	49.0	50.2	50.4



**Tab. S5** - Root dry weight, nitrogen and carbon concentration of black pine and red pine tree sampled from study sites.

Region	Tree species	stand age	DBH (cm)	Height (m)	Root (kg)	Nitrogen (%)	Carbon (%)
GH	black pine	40	20.9	14.2	41.79	0.21	46.25
GH	black pine	40	15.6	8.4	23.93	0.23	45.72
GH	black pine	40	11.6	10.4	8.05	0.17	46.14
GH	black pine	40	18.7	14.2	49.46	0.15	46.37
GY	black pine	15	9.4	4.7	10.41	0.31	45.95
GY	black pine	15	7.7	4.4	4.66	0.22	46.63
JJ5	black pine	45	24.3	18.4	100.30	0.09	45.82
JJ5	black pine	45	16.7	14.7	32.40	0.32	45.20
JJ3	black pine	51	32.9	21.2	151.29	0.35	42.36
JJ3	black pine	51	24.5	17.8	58.81	0.20	45.07
JJ3	black pine	51	28.5	22.2	148.19	0.10	45.73
JJ3	black pine	51	17.8	15.2	52.05	0.09	44.47
JJ3	black pine	51	22.1	12.9	47.50	0.06	45.78
JJ3	black pine	51	26.6	18.2	133.16	0.15	43.73
JJ3	black pine	51	23.6	20.2	73.61	0.06	45.65
JJ3	black pine	51	23	16.1	70.31	0.12	42.46
JJ5	red pine	39	16.6	8.5	6.70	0.45	42.10
JJ5	red pine	35	15.6	12.2	15.56	0.55	42.39
HY	red pine	38	15.0	16.1	16.16	0.31	45.44
HY	red pine	38	23.9	12.7	32.28	0.26	47.36
SC	red pine	37	18.4	12.6	11.63	0.52	40.40
SC	red pine	37	18.4	12.6	25.22	0.32	46.78
UR	red pine	19	6.8	8.0	2.87	0.30	42.41
UR	red pine	19	11.4	10.0	4.52	0.40	45.17